

REMARKS

Claims 1-18, 23 and 24 are pending in the present Application. Claims 6 and 15 are canceled with this Amendment.

Claims 1 and 10 have been amended to recite two or more acids, which provides antecedent basis for claims 2 and 11, respectfully. The limitations of claims 6 and 15 have been incorporated into claims 1 and 10, respectively. Claims 1 and 10 have also been amended to recite that copper is electroplated on the discontinuous metal seed layer. Support for this is found throughout the Specification, such as at page 11, lines 22-28 and page 12, lines 19-22. Claims 1 and 10 have also been amended to recite that the substrate comprises apertures having diameters of 0.18 μm or smaller. This is supported by the Specification at page 12, lines 6-12. Claims 1 and 10 have been further amended to recite that at least one acid is a and wherein at least one acid is a (C₃-C₆)alkylsulfonic acid. This is supported by the Specification at page 7, lines 19-22. Claim 12 has also been amended to recite a method of manufacturing a semiconductor device. Support for this is found in the Specification at page 11, last 2 lines to page 12, line 5. Claims 2-4, 7, 11-13 and 16 have been amended only to correct grammatical usage and not to overcome any prior art rejection. Claims 8 and 17 have been amended only to change their dependencies and not to overcome any prior art rejection. No new matter is added with this Amendment.

Claims 1-18, 23 and 24 have been rejected under 25 USC § 112, second paragraph, as being indefinite for failing to point out particularly and claim distinctly the subject matter which Applicants regard as their invention. Applicants respectfully traverse.

Claims 1 and 10 have been amended to recite two or more acids. Accordingly, claims 2 and 11 have antecedent basis. Claims 1 and 10 have also been amended to recite the step of electroplating copper.

Claims 2-5, 7, 11-13 and 16 have been amended to change grammatical expressions.

Claims 9 and 18 are fully supported by the Specification at page 8, lines 25-26.

In view of the foregoing, Applicants respectfully request that this rejection be withdrawn.

Claims 1-18, 23 and 24 have been provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 10-27 of copending Application Ser. No. 09/976,421 (Morrissey et al.). Applicants respectfully traverse.

Claims 1-18, 23 and 24 have been rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of US 6,531,046 (Morrissey et al.). Applicants respectfully traverse.

There is nothing in the claims of either Application Ser. No. 09/976,421 or the '046 patent that suggests the use of two or more acids in a copper electroplating bath where at least one of the acids is a (C₃-C₆)alkylsulfonic acid. In fact, (C₃-C₆)alkylsulfonic acids are not mentioned anywhere in either of these documents. Thus, there is nothing in the claims of either Application Ser. No. 09/976,421 or the '046 patent that suggests Applicants' claimed invention. Applicants respectfully request that both the provisional double patenting rejection over Application Ser. No. 09/976,421 and the double patent rejection over US 6,531,046 be withdrawn

Claims 1-18, 23 and 24 have been rejected under 35 USC § 102(e) as being anticipated by US Application Publication No. 2002/0043468 (Mikkola et al.). Applicants respectfully traverse.

Applicants claimed invention requires a copper electroplating bath comprising an electrolyte comprising two or more acids, where at least one acid is a (C₃-C₆)alkylsulfonic acid. The Mikkola publication fails to disclose Applicants' specifically claimed range. While the range of alkylsulfonic acids disclosed in Mikkola et al. overlaps Applicants' claimed range, there is no specific teaching in Mikkola of a copper electroplating bath comprising an electrolyte comprising a mixture of acids wherein at least one acid is a (C₃-C₆)alkylsulfonic acid. Applicants submit that the present invention is not anticipated by Mikkola et al. and respectfully request that this rejection be withdrawn.

Claims 1-18, 23 and 24 have been rejected under 35 USC § 102(e) as being anticipated by US Application Publication No. 2002/0088713 (Merricks et al.). Applicants respectfully traverse.

As described above, Applicants claimed invention requires a copper electroplating bath comprising an electrolyte comprising two or more acids, where at least one acid is a (C₃-C₆)alkylsulfonic acid. The Merricks publication fails to disclose Applicants' specifically claimed range. While the range of alkylsulfonic acids disclosed in Merricks et al. overlaps Applicants' claimed range, there is no specific teaching in Merricks of a copper electroplating bath comprising an electrolyte comprising a mixture of acids wherein at least one acid is a (C₃-C₆)alkylsulfonic acid. Applicants submit that the present invention is not anticipated by Merricks et al. and respectfully request that this rejection be withdrawn.

Claims 1-18, 23 and 24 have been rejected under 35 USC § 103(a) as being unpatentable over Dahms et al. (US 5,433,840). Applicants respectfully traverse.

Applicants claims are directed to a method of providing a seed layer substantially free of discontinuities and a method of manufacturing a semiconductor device. Further, the semiconductor device of Applicants' claims comprises apertures having a size of less than or equal to 0.18 micron. The Dahms patent fails to disclose semiconductor devices at all and further fails to disclose or suggest the semiconductor devices comprising apertures having a size of 0.18 micron or less. Dahms et al. are directed to depositing copper on printed wiring boards. Specifically, the examples of Dahms et al. discuss "scratched copper laminate". Still further, Dahms et al. only disclose methanesulfonic acid, a (C₁)alkylsulfonic acid. Nothing in Dahms et al. teaches or suggests higher alkylsulfonic acids. Specifically, there is nothing in this patent that teaches or suggests a combination of two or more acids where at least one acid is a (C₃-C₆)alkylsulfonic acid.

Copper plating in the printed wiring board industry and in the semiconductor industry face different challenges. One such challenge is feature size. Sizes of semiconductor features are generally much less than 1 micron, such as 0.18 micron or even smaller. The sizes of semiconductor features continue to shrink. Such small features present a challenge of depositing

copper within the features without void formation. Features in printed wiring boards are much bigger than those in semiconductors. Chemistry that is effective in plating copper on a printing wiring board is not necessarily effective in plating copper *within* the small features required for semiconductor devices.

Thus, Applicants' submit that the Examiner has not made out a prima facie case of obviousness and respectfully request that this rejection be withdrawn.

Favorable consideration in the form of a notice of allowance is respectfully requested.

Respectfully submitted,

A handwritten signature in cursive script that reads "S. Matthew Cairns".

S. Matthew Cairns, Ph.D.
Attorney for Applicant
Registration No. 42,378

c/o EDWARDS & ANGELL
PO Box 9169
Boston, MA 02209
Date: